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Apparent Associations Between the Solar Interior, Corona, and Solar Wind

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Using polarized brightness (pB) measurements made by the High Altitude Observatory (HAO) Mauna Loa Mk III K-coronameter, we investigate the daily changes of path-integrated density at 1.15 Ro representing mainly longitudinal structure but also temporal variations near the Sun. We relate these coronal features to the interior of the Sun by comparing them with the subsurface large-scale velocity patterns associated with torsional oscillations. Specifically, we find that the latitudinal profile of the correlation of density variations between latitudes separated by 20 deg is similar to that of the subsurface zonal variations of the Sun's differential rotation from the same time period in 1996. From equator to pole, bands of high and low density correlation appear to be associated with those of slower (retrograde) and faster (prograde) rotation, respectively. We also show that polar coronal holes are distinguished by non-recurring longitudinal structure, as opposed to recurring structure in the neighboring quiet Sun, with the standard deviation of the longitudinal variations of pB being half of that of the quiet Sun. These distinct signatures of the longitudinal structure of coronal density including their dependence on latitude are also present in 1993-1994, and replicated in the Ulysses proton density measurements of the distant solar wind during the same time, showing that polar coronal holes extend radially into the solar wind. Since polar coronal holes and the quiet Sun are associated with retrograde rotation, and the polar coronal hole boundary with prograde rotation, the manifestation of these coronal features in the solar wind also reflect the association of the solar wind with the dynamics of the solar interior.

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